

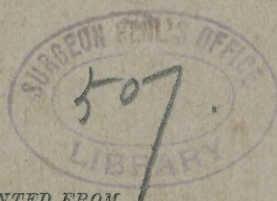
Ewing (Gas)

A STUDY OF THE
LEUCOCYTOSIS OF LOBAR
PNEUMONIA

BY

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A STUDY OF THE LEUCOCYTOSIS OF LOBAR PNEUMONIA.

DURING the past few years the subject of leucocytosis has been rapidly growing in interest. It has long been known that in certain conditions, both physiological and pathological, the number of leucocytes in the blood rises considerably above the normal limit—eight thousand to the cubic millimetre. Only recently, however, has this phenomenon received any systematic study, and its practical importance been recognized.

At present the extent of our clinical knowledge may be briefly summarized as follows:

During digestion and in pregnancy there is a moderate physiological increase in the number of leucocytes in the blood.

In many pathological conditions, either cachectic or febrile, a constant and considerable leucocytosis has been demonstrated. The principal cachectic conditions producing leucocytosis are three in number: 1. The acute anæmia following hæmorrhage. 2. The chronic anæmia of diseases of the blood and of malignant neoplasms. 3. The condition of the blood before death, giving an “ante-mortem” leucocytosis.

Finally, there is the leucocytosis of inflammatory conditions, which is a regular accompaniment of many febrile diseases. Of these may be mentioned lobar pneumonia, inflammations of serous membranes, meningitis, septicæmia, acute articular rheumatism, scarlatina, diphtheria. Measles, typhoid fever, and pulmonary tuberculosis have been shown to be important exceptions in this class. In typhoid fever, the number of leucocytes is regularly sub-

normal, while in phthisis it is usually absent or inconspicuous.

The leucocytosis of lobar pneumonia has received more attention than that of any other febrile condition. Its course during the disease has been carefully followed in sixteen cases recently reported by Laehr. Its relation has been noted to the height of the fever, to the extent of the pulmonary lesion, to the amount of poison generated by the disease, and to the reaction of the system. Some have claimed that the degree of leucocytosis follows exactly the extent of the local lesion; others, that it is regulated by the amount of poison generated and by the character of the systemic reaction excited by the disease. Its relation, also, to prognosis has been considered and attempts made to base a favorable prognosis on a high degree of leucocytosis. Von Jaksch* has observed that cases of lobar pneumonia unaccompanied by leucocytosis are of unfavorable prognosis. Laehr† reports a case in which a relapse was heralded by a recurrence of leucocytosis after its disappearance with the crisis. Laehr and Rieder‡ believe that the examination of the blood is of great value in the diagnosis between lobar pneumonia and typhoid fever. The number of leucocytes in the blood in phthisis has been found so variable that no definite rules have been established as to the use of the blood count in distinguishing this disease from pneumonia.

In order to test the truth of the statement that a large increase in the number of leucocytes in the blood offers a favorable prognosis in lobar pneumonia, the writer examined the blood in a hundred and one cases of this disease occurring in Roosevelt Hospital during the first five months of the year 1893. In the belief that the determination of leucocytosis could hardly become a matter of general utility if a lengthy series of examinations were required in each case, the observations were limited to a single examination made during the height of the disease, which is a practical procedure. Laehr's investigations, in which

* Von Jaksch. *Clinical Diagnosis*.

† Laehr. Ueber das Auftreten von Leucocytose bei croupösen Pneumonie, *Berliner klinische Wochenschrift*, Nos. 36, 37, 1893.

‡ Rieder. *Beiträge zur Kenntniss der Leucocytose*.

the entire course of the leucocytosis was followed, show that a single examination made at such a time gives an accurate indication of the leucocytosis in a case of pneumonia.

Technique.—The instrument usually employed in counting white blood cells is known as the Thoma-Zeiss leucocytometer. In the method recommended for this instrument the blood is treated with a three-tenths-per-cent. aqueous solution of acetic acid, which destroys the red blood cells, leaving only the white. In using this method several disadvantages became apparent. The quantity of blood required is inconveniently large. Acetic acid obscures the outlines of the leucocytes and it is often difficult to distinguish them from *débris* left by the red blood cells. The leucocytes become very cohesive and appear in the counting chamber in considerable masses, in spite of persistent efforts to secure the even distribution necessary for an accurate count. This method was therefore discarded and the ordinary instrument for counting *red* blood cells (the Thoma Zeiss) was used in all the cases.

The examination of the blood was made regularly between the hours of 9 and 12 P. M. The blood was drawn from the finger tip by a deep fine puncture, which usually causes a copious flow. It was thoroughly mixed in the pipette with a three-per-cent. salt solution colored deeply by gentian violet (about one per cent. of a saturated alcoholic solution). The drop received into the counting chamber was rejected unless it showed an even distribution of red cells. The first drop, after the leucocytes had been estimated, was replaced always by a second, and the second often by a third, and the average of the two or three counts was finally accepted.

The blood was examined in this way in about a hundred and fifteen cases of febrile disorder. They were principally cases of lobar pneumonia; but this number includes several cases of typhoid fever, typhus fever, acute phthisis, empyema, and one case of actinomycosis of the lung. Several cases in which lobar pneumonia was wrongly suspected to exist and no leucocytosis found, and some cases of chronic phthisis in which the usual variable result was obtained, are not reported.

The results are presented in the following tables :

Lobar Pneumonia.

No.	Name.	Age.	Location of lesion.	Highest rectal temperature.	CHARACTER OF		Complications.	Outcome.	Leucocytes, per c. mm.
					Infection.	Reaction.			
1	Meyers.	35	R. u.*	Degrees F. 106.2	Severe.	Vigorous.	.....	L.† 14th day.	23,000
2	Hirsh.	72	R. l.	104.4	Mild.	Slight.	Cellulitis.	L. 5th day.	11,000
3	Maher.	28	R. l.	104.2	Moderate.	Moderate.	.....	L. 6th day.	20,000
4	Locklin.	20	R. u.	105.2	Severe.	Vigorous.	.....	C. 7th day.	20,000
5	Smith.	17	3d R., L. l.	105.8	"	"	.....	C. 10th day.	27,000
6	Kirby.	11	R. u. and l., L. l.	105.0	"	"	.....	D. 5th day.	30,500
7	Lloyd.	33	R. u.	104.4	"	Slight.	Nephritis.	D. 5th day.	15,000
8	Gibson.	38	R. u. and m.	104.0	"	Moderate.	Pericarditis.	D. 8th day.	23,000
9	Parker.	23	R. u.	104.8	"	Slight.	Peritonitis.	D. 7th day.	14,000
10	McCord.	40	R. u. and l.	106.8	"	Vigorous.	.....	L. 8th day.	27,000
11	McGuire.	32	R. u. and l.	104.4	Moderate.	Moderate.	.....	L. 10th day.	18,000
12	Rosa.	36	R. l.	105.0	Severe.	Vigorous.	Nephritis.	D. 2d day.	31,000
13	Hanley.	35	3d R.	105.4	"	"	.....	L. 8th day.	31,500
14	Coyne.	36	Both l.	106.8	"	"	Alcoholism.	D. 4th day.	23,000
15	Louden.	39	R. m. and l.	104.0	"	"	Pericarditis.	D. 6th day.	24,000
16	Brown.	21	L. l.	103.8	Mild.	Slight.	.....	L. 8th day.	15,000
17	McCarthy.	20	L. l.	103.2	"	"	.....	C. 7th day.	15,000
18	Boland.	49	3d R.	105.4	Severe.	Vigorous.	.....	L. 9th day.	17,000
19	Emus.	39	R. u.	105.4	"	Slight.	Alcoholism.	D. 5th day.	6,000
20	Mortimer.	18	R. u. and l., L. l.	105.2	"	Vigorous.	Pleurisy.	L. 14th day.	21,000
21	Davin.	28	L. u.	107.0	"	Slight.	Pericarditis.	D. 8th day.	6,000

* R. = Right side. L. = Left side. u. = upper lobe. m. = middle lobe. l. = lower lobe. † L. = Lysis. C. = Crisis. D. = Death.

22	Cockrane.	62	3d R.	103.0	Moderate.	Moderate.	Pericarditis.	D. 10th day.	23,000
23	McAleese.	20	R. u.	104.2	"	"	.....	C. 8th day.	14,500
24	O'Connor.	60	L. l.	103.8	"	"	.....	L. 9th day.	25,000
25	Clark.	72	L. u.	103.8	Mild.	Slight.	.....	L. 6th day.	18,000
26	Lynch.	48	R. u. and l.	104.6	Moderate.	"	.....	D. 6th day.	13,000
27	Smith.	61	R. l.	104.8	Severe.	"	.....	D. 8th day.	4,000
28	White.	28	3d R.	105.4	"	Vigorous.	.....	D. 7th day.	23,000
29	Coyle.	30	R. u.	105.6	"	Moderate.	.....	D. 7th day.	17,000
30	Guttenberg.	21	L. l.	103.2	Moderate.	"	.....	D. 3d day.	21,000
31	Lyons.	32	R. u.	104.6	Severe.	"	.....	C. 7th day.	21,000
32	Mayer.	65	Both l.	105.0	"	Vigorous.	.....	D. 11th day.	28,000
33	Byrnes.	29	R. u. and l.	104.2	Moderate.	Moderate.	.....	L. 9th day.	22,000
34	Stack.	53	L. l.	105.0	Severe.	Vigorous.	.....	C. 10th day.	42,000
35	Vick.	21	Both l.	103.6	Moderate.	"	.....	L. 14th day.	26,000
36	Aslar.	20	L. l.	104.4	"	"	.....	C. 6th day.	14,000
37	Max.	37	R. u.	103.0	Severe.	Slight.	.....	D. (?)	7,000
38	Havens.	39	3d R.	105.8	"	Vigorous.	.....	D. 7th day.	23,500
39	Reilly.	45	R. l.	103.4	"	"	.....	C. 7th day.	40,500
40	Colton.	45	R. m.	103.6	Moderate.	"	.....	L. 5th day.	31,000
41	Haywood.	37	R. u. and l.	104.0	"	"	.....	L. 7th day.	17,000
42	Ormsby.	20	3d R.	104.0	Severe.	"	.....	D. 6th day.	14,000
43	Geier.	20	R. u. and l.	105.8	"	Vigorous.	.....	C. 8th day.	31,000
44	Hanks.	23	L. l.	106.2	"	"	.....	L. 11th day.	36,000
45	Tallakson.	42	Both l.	104.0	Moderate.	Moderate.	.....	D. 5th day.	20,500
46	Butler.	38	R. u. and m.	105.0	Severe.	Slight.	Faecal impaction.	D. 5th day.	6,000
47	Edgar.	35	L. l.	106.0	"	Vigorous.	"	D. 5th day.	34,000
48	Regan.	30	Entire lung.	104.0	"	"	.....	L. 7th day.	32,000
49	Serie.	52	R. l. and m.	103.0	"	Slight.	.....	L. 18th day.	19,000
50	Rosch.	34	L. u.	106.0	"	Vigorous.	.....	D. 6th day.	21,000
51	Fox.	32	R. u.	103.8	Mild.	Slight.	.....	L. 11th day.	18,000

Lobar Pneumonia.—(Continued.)

No.	Name.	Age.	Location of lesion.	Highest rectal temperature.	CHARACTER OF		Complications.	Outcome.	Leucocytes, per c. mm.
					Infection.	Reaction.			
52	McGar.	37	L. l.	Degrees F. 104.0	Moderate.	Moderate.	Pericarditis.	L. 12th day.	14,000
53	Feeley.	24	L. l.	103.8	"	"	Gangrene.	L. 15th day.	38,000
54	Chambers.	33	L. u. and l.	106.0	Severe.	Vigorous.	Alcoholism.	D. 13th day.	29,000
55	Hanafy.	28	R. u.	104.2	Mild.	Slight.	.....	C. 3d day.	13,500
56	Lundin.	34	L. u. and l.	105.8	Severe.	Vigorous.	.....	L. 9th day.	21,000
57	Port.	22	R. l.	106.8	"	"	.....	L. 10th day.	24,000
58	Murphy.	32	R. u.	105.0	"	"	.....	L. 7th day.	23,500
59	Feeney.	51	L. l.	103.4	Mild.	Slight.	.....	L. 7th day.	19,000
60	Keenan.	27	R. l.	106.0	Severe.	Vigorous.	.....	D. 7th day.	24,000
61	Albony.	21	L. l.	104.8	Moderate.	Moderate.	.....	L. 11th day.	15,000
62	Holden.	19	R. u.	105.8	Severe.	Vigorous.	Pleurisy.	L. 9th day.	43,000
63	Kearney.	54	L. l.	102.8	Mild.	Slight.	.....	C. 8th day.	16,000
64	Loomis.	40	R. l.	105.0	Severe.	Vigorous.	.....	L. 12th day.	39,000
65	Weit.	53	3d R.	105.0	"	"	.....	D. 5th day.	26,000
66	Mulvey.	40	L. l.	104.8	Moderate.	Moderate.	Alcoholism.	D. 7th day.	19,000
67	Stokes.	24	Both l.	105.0	Severe.	Vigorous.	.....	L. 6th day.	30,500
68	Nelson.	28	R. l.	102.4	Mild.	Slight.	.....	L. 15th day.	23,000
69	Coombs.	39	R. u. and l.	105.0	Severe.	Vigorous.	.....	D. 9th day.	33,000
70	Mosher.	25	R. l.	104.0	Moderate.	Moderate.	.....	L. 7th day.	21,500
71	McName.	27	R. l.	105.6	Severe.	Vigorous.	.....	L. 8th day.	41,000
72	Cook.	26	L. l.	106.4	"	"	Alcoholism.	D. 4th day.	26,000
73	Rasher.	27	R. l.	105.0	"	"	.....	L. 4th day.	38,000
74	Woods.	31	Both l., R. u.	106.0	"	"	.....	D. 8th day.	26,500
75	Lathrop.	45	L. l.	103.2	Moderate.	Moderate.	.....	L. 18th day.	28,000

76	Welsh.	29	3d R.	103.4	"	"	.....	.....	L. 7th day.	22,000
77	McGown.	42	L. I.	103.0	Mild.	Slight.	.....	.....	L. 9th day.	11,000
78	McLaughlin.	55	R. I.	104.8	Severe.	Vigorous.	.....	.....	D. 6th day.	55,000
79	Munane.	28	Both I.	104.0	Moderate.	Moderate.	Rheumatism, pericarditis.	.....	L. 25th day.	22,000
80	Ginty.	37	R. I.	104.0	"	"	Nephritis.	.....	C. 3d day.	24,500
81	Hastings.	33	R. I.	105.0	Severe.	Vigorous.	Alcoholism.	.....	L. 7th day.	23,500
82	Stane.	20	Both I.	103.0	"	"	Endocarditis.	.....	D. 6th day.	34,000
83	Nolan.	21	Both I.	104.4	"	"	Rheumatism, pericarditis.	.....	L. 10th day.	32,500
84	McCrane.	28	L. I.	103.4	Mild.	Slight.	"	.....	L. 17th day.	12,500
85	Haywood.	32	R. I.	103.4	"	"	Rheumatism.	.....	L. 8th day.	14,500
86	Fox.	29	R. I.	103.8	"	"	"	.....	L. 7th day.	18,000
87	Bram.	27	Both I.	105.0	Severe.	Vigorous.	.....	.....	L. 8th day.	23,000
88	Glavin.	45	L. I.	103.8	Mild.	Slight.	Nephritis.	.....	L. (?)	19,000
89	McShea.	41	R. I.	104.6	Severe.	"	Typhoid, peritonitis.	.....	D. 4th day.	12,000
90	Barry.	24	R. I.	105.0	"	"	Phthisis.	.....	D. 3d day.	5,000
91	Hackett.	51	R. I.	104.0	Moderate.	Moderate.	Gangrene.	.....	D. (?)	21,000
92	Boyle.	35	R. u.	104.6	Severe.	Slight.	.....	.....	D. 5th day.	10,500
93	Lear.	34	R. u. and l.	104.6	"	Vigorous.	.....	.....	L. 7th day.	56,000
94	Fox.	30	L. I.	104.0	Moderate.	Vigorous.	.....	.....	C. 6th day.	22,500
95	Keen.	31	R. u. and l.	106.0	Severe.	Vigorous.	.....	.....	L. 20th day.	26,000
96	Kelly.	8	L. I.	105.0	"	"	Meningitis.	.....	D. 6th day.	47,000
97	Riley.	33	R. I.	105.2	"	"	.....	.....	L. 7th day.	25,500
98	Brown.	27	L. I.	103.8	Mild.	Slight.	.....	.....	L. 6th day.	16,000
99	Bonner.	29	R. I.	105.4	Severe.	Vigorous.	Alcoholism.	.....	L. 8th day.	26,000
100	Eustace.	20	R. I.	105.0	"	"	Pericarditis.	.....	C. 8th day.	34,000
101	Holden.	21	3d R., L. I.	105.6	"	Slight.	.....	.....	D. 5th day.	14,500

Miscellaneous.

No.	Name.	Age.	Diagnosis.	Leucocytes.
102	Andrews.	18	Acute phthisis.	2,000
103	Dessar.	21	" "	11,000
104	Stark.	28	" "	12,000
105	Gram.	38	" "	9,000
106	Minton.	36	Empyema.	20,000
107	Fax.	33	"	22,500
108	Gavin.	22	Typhoid fever.	8,000
109	Pearson.	41	" "	6,000
110	Barry.	24	" "	5,000
111	Byrnes.	42	Typhus fever.	5,000
112	Black.	23	" "	8,000
113	Sadler.	25	" "	9,000
114	Morrissey.	28	" "	7,000
115	Hillier.	34	Actinomycosis of lung.	21,500

Relation of Leucocytosis in Pneumonia to the Extent of the Pulmonary Lesion.—Limbeck, Pick, and others call attention to the fact that the degree of leucocytosis bears a very constant relation to the extent of the local lesion, and it is both asserted and denied that the extent of the lesion determines the grade of leucocytosis. An examination of the cases under discussion seems in general to show that the extent of the lesion influences considerably the number of leucocytes in the blood. In sixty-three cases in which one lobe was involved the average number of leucocytes was 20,000.

In twenty-four cases, involving two lobes, the average was 22,700. In twelve cases, involving three lobes, the average rose to 25,000.

In one case in which four lobes were affected the number was 27,000; and in Case 48, in which all the lobes were successively attacked, the number of leucocytes reached 32,000.

In the entire series, therefore, the number of leucocytes increases regularly with the number of lobes affected. On the other hand, the seven highest numbers observed accompanied the involvement of a single lobe. Hence the above assertion, while true of a series of cases, is an unsafe rule to apply to individuals. Further, in ten cases in which the lesion extended to the opposite pleura, the pericardium, or the peritonæum, the average degree of leucocytosis was relatively low (17,000).

Relation of Leucocytosis in Pneumonia to the Amount of Poison generated and to the Systemic Reaction.—That the prognosis of pneumonia depends upon the amount of poison generated and the vigór of the systemic reaction more than upon the extent of lung involved is a fundamental clinical rule. That the degree of leucocytosis in pneumonia also depends upon these two factors more than upon the extent of the lesion can be demonstrated, it is believed, from the foregoing cases.

Where the character of the infection was very mild the number of leucocytes was often correspondingly low, but since thirty-five per cent. of the fatal cases showed very slight leucocytosis, the amount of poison generated can hardly be considered a regular factor in determining the degree of leucocytosis.

In order to draw some conclusion about the relation of leucocytosis to systemic reaction, the cases were carefully divided, according to their clinical aspect, into three groups. The reaction of the system was judged as *vigorous* when the rectal temperature reached 105° or higher; when the pulse, while tumultuous, retained its force until the anatomical lesion was well advanced; when the general condition at the height of the disease was markedly sthenic; and when a fatal issue seemed not to be inevitable, but to result either from some complication or after a doubtful course.

The systemic reaction was considered *moderate* when the temperature was between 104° and 105°, while the other symptoms were less severe.

In other cases the reaction of the system was regarded as *slight*, with a temperature never reaching 104° and with moderate prostration. The reaction was regarded as slight or deficient also when the pulse began to fail very early; when the disease throughout was "badly borne," pursuing an asthenic, often rapidly fatal course.

In forty-seven cases, marked by a severe and powerful systemic reaction, the average number of leucocytes was 31,000. In twenty-seven moderate cases the average was 20,000. In twenty-seven cases, characterized by slight and deficient systemic reaction, the number of leucocytes averaged 9,000. Of eleven asthenic cases, placed with the

last division, there was in six a decrease in the number of leucocytes.

The Diagnostic Value of Leucocytosis: Pneumonia vs. Typhoid Fever.—While it has been known for some years that there is no leucocytosis in typhoid fever, it is only within the past two years that our knowledge of the leucocytosis of lobar pneumonia has warranted any positive statement as to its value in the diagnosis of the latter disease. That the examination of the blood may be decisive evidence in distinguishing obscure forms of pneumonia from typhoid fever, the following cases may show. On account of the uncertain estimate then placed on such evidence, the blood count did not influence the diagnosis in any of the cases.

Eustacé (100): Gradual onset with indefinite chill, dry cough, general pains, no dyspnœa. Examination of lungs showed mild bronchitis. Abdominal symptoms prominent. Regarded as typhoid fever and persistently bled. Leucocytes, 34,000. Physical signs of pneumonia of right lower lobe began to appear on the tenth day—the day of defervescence by crisis.

Barry (110): Chill, cough, dyspnœa, general chest pains. At bases of both chests, dullness, high-pitched breathing, a few moist râles. Pronounced a case of pneumonia. Leucocytes, 5,000. Two days later the lungs had cleared and typhoid symptoms were apparent. Relapse on the twenty ninth day. Perforation on the thirty-seventh day. Pneumonia of right lower lobe on the fortieth day (90). Leucocytes, 5,000. Death on the forty-third day. This is one of the cases in which lobar pneumonia was unaccompanied by leucocytosis. It was also an excellent illustration of entire failure of systemic reaction, the pneumonia being masked by abdominal symptoms and only discovered by the routine examination of the chest.

Pearson (109): Chills, general chest pains, dry cough, no abdominal symptoms. General bronchitis, with diminished breathing at base of left chest. Regarded as pneumonia. Leucocytes, 6,000. Four days later the lungs had cleared, abdominal symptoms supervened, and the temperature ran a typical typhoid course.

Gavin (108): Chill, cough, subjective dyspnœa. Few moist râles, possibly slight dullness, high-pitched voice and breathing at right apex. No abdominal symptoms. Regarded as pneumonia, but careful daily examination failed to locate it. Leucocytes, 8,000. Five days later, rose spots, diarrhœa, and further typical typhoid course.

Pneumonia vs. Typhus Fever.—The writer has been unable to find reported any examinations of the blood in typhus fever. Four such cases were encountered during the winter, and in none was there found any increase in the number of leucocytes. It is believed, therefore, that the examination of the blood is probably of equal value in the more difficult diagnosis between lobar pneumonia and typhus fever.

Byrnes (111): Chill, slight stitch in right axilla (?), febrile dyspnœa, muco-purulent sputum. Slight dullness, diminished breathing, a few moist râles at bases of both chests, more marked at right. Regarded as certainly pneumonia. Leucocytes, 5,000. Physical signs were found not to advance satisfactorily after very careful examination twice daily, and on fourth day after admission typhus eruption appeared.

Black (112): Chill, stitch in side, febrile dyspnœa. Slight dullness, diminished breathing, and moist râles at bases of both chests, especially the left. Regarded as pneumonia. Leucocytes, 8,000. Three days later bronchitis had cleared up and typhus eruption appeared.

McCord (10): Sent to hospital as a suspicious case of typhus fever. Three days before had had slight chill; no chest pains, no expectoration, no dyspnœa. Pulmonary signs negative. Typhus and pneumonia were regarded as possibilities. Leucocytes, 27,000. No definite physical signs of pneumonia developed till after eight days of remittent pyrexia, when the case defervesced by rapid lysis.

In two other cases of typhus fever (113, 114) no leucocytosis was found.

Pneumonia vs. Tuberculosis.—As has been said above, the number of leucocytes in the blood in pulmonary tuberculosis has been found so variable that no definite opinion has been reached as to the value of the blood count in distinguishing between lobar pneumonia and phthisis. Leu-

cocytosis, however, has been shown to occur only in a minority of the cases of tubercular inflammation of the lung, and in these the number of leucocytes seldom reaches 15,000. Possibly the explanation of this occasional leucocytosis may be found in the first three cases next cited, which, at the time of the examination, were acute processes without suppurating cavities. In the writer's observation, while moderate leucocytosis has been found in chronic phthisis with suppurating cavities, yet in those cases of acute phthisis which clinically resemble lobar pneumonia the white blood cells have shown only the very slightest increase. It is possible also that the leucocytosis reported in some cases of phthisis may be due to chronic anæmia, to a circumscribed pleurisy, or to a moderate lobar pneumonia, which frequently complicate the disease (as was shown by autopsy in Case 91).

The absence of leucocytosis may therefore be considered as valuable evidence in a decision between acute phthisis and all forms of lobar pneumonia, except the very mild and the severe asthenic cases. It was found to be so in the following instances:

Andrews (102): Professed to have been sick a week with chill, sudden pain in left side, cough, muco-purulent sputum, in which no tubercle bacilli were found. Temperature, 106°. Consolidation of left upper lobe. Regarded as certainly pneumonia. Leucocytes, 2,000. Lesion rapidly extended. Death in fifth week. Autopsy.

Dessar (103): Ill fourteen days, with usual history and signs of pneumonia of left lower lobe. Fairly typical rusty sputum in which no tubercle bacilli were found. Leucocytes, 10,000. Death on the twenty-seventh day. Acute phthisis, cavity in lower lobe, previously supposed to be gangrene, from fœtid odor and apparent absence of bacilli.

Gram (105): A patient suffering from chronic Bright's disease and "bronchitis." Fever suddenly rose, cough became worse, with dyspnœa, stitch in left side. Signs of slight consolidation now found in front of the left upper lobe. Regarded as pneumonia. Leucocytes, 9,000. After ten days tubercle bacilli were finally found in the sputum.

Stark (104): Acute illness of few days' standing, with

usual history of a moderately severe pneumonia of right upper lobe. Leucocytes, 12,000. Bacilli afterward found in the sputum.

Keen (95): Acute illness of ten days' duration. Previous history favored tuberculosis. General bronchitis; consolidation of most of right lung. Treated as phthisis. Leucocytes, 26,000. Repeated examination failed to find tubercle bacilli in the sputum, and recovery followed after tardy resolution.

Obscure Forms of Pneumonia.—The examination of the blood gave correct evidence in cases of obscure pneumonia when physical signs and other symptoms were indefinite.

Glavin (48): Suffering from chronic nephritis. Had fever, cough, muco-purulent sputum. Some indefinite signs over angle of left scapula raised a suspicion of pneumonia. These signs cleared up in a few days, and the idea of pneumonia was abandoned. The patient died in uræmia, and remains of pneumonia were found in the above location. Leucocytes, 19,000.

Ginty (80): A case of nephritis. One morning awoke with severe chill and pain in right axilla; temperature, 104°. Pulmonary signs insufficient for diagnosis. Leucocytes, 24,500. Disappearance of urinary chlorides. Temperature fell by crisis on the third day.

Pneumonia vs. Empyema and Actinomycosis of the Lung.—In two fatal cases of empyema and in one case of actinomycosis of the lung the leucocytes were considerably increased, and the examination of the blood was of no value in distinguishing the diseases from lobar pneumonia.

The Prognostic Value of Leucocytosis in Pneumonia.—Of one hundred and one cases of pneumonia, thirty-seven were fatal. In the fatal cases the average number of leucocytes found was nineteen thousand five hundred; or from these thirty-seven, selecting thirteen cases occurring in fairly robust adults, the average may be brought as low as seventeen thousand. In sixty-four recoveries the average was twenty-four thousand one hundred. Evidently the difference between the average leucocytosis of a favorable and that of a fatal case is too slight to warrant strict confidence in its prognostic value. Not only are the averages close, but many of the fatal cases showed a very marked leucocytosis.

It may be said, therefore, that a considerable leucocytosis is no indication that the case will pursue a favorable course. Very accurate predictions, however, may be made from the examination of the blood when the relative value of such evidence is carefully estimated; for, of the fatal cases, above mentioned, attended with marked leucocytosis, thirteen may be explained by serious complications, such as nephritis, alcoholism, pericarditis, endocarditis, and old age. In fact, in only three of the fatal cases did a marked leucocytosis, when taken in apparently proper connection with other features of the case, point to a wrong conclusion. In several instances where recovery followed, a high leucocytosis was found at a time when the condition was considered hopeless.

An examination of the deaths will show that in severe forms of lobar pneumonia a slight leucocytosis is a very unfavorable sign. In six fatal cases the number of leucocytes was subnormal. In eleven fatal cases the average number was nine thousand. Not one case recovered in which the disease was of even moderate severity when the number of leucocytes fell below fourteen thousand. In several instances, again, a slight leucocytosis seemed at the time the only unfavorable prognostic sign in cases ending fatally.

Summary.—In most cases of lobar pneumonia there is a marked leucocytosis.

The leucocytosis of lobar pneumonia may be absent or inconsiderable—(a) in very mild cases; (b) in very severe cases in which the reaction of the system is slight.

The degree of leucocytosis in pneumonia is proportional, on the average, to the extent of the local lesion, but it follows much more exactly the grade of systemic reaction to the poison generated.

In cases of acute tubercular inflammation of the lung, clinically resembling lobar pneumonia, there was no leucocytosis.

In pulmonary phthisis complicated by suppurating cavities, exudative pneumonia, pleurisy, or chronic anæmia, there was usually a moderate leucocytosis.

In typhoid and typhus fevers there was no leucocytosis.

In empyema and actinomycosis of the lung there was considerable leucocytosis.

In obscure forms of lobar pneumonia, in which ordinary physical signs and rational symptoms are insufficient for diagnosis, the examination of the blood may give useful evidence.

Well-marked leucocytosis is a valuable aid in the differential diagnosis between lobar pneumonia and typhoid or typhus fevers.

In acute apical lesions the absence of leucocytosis is decisive evidence in favor of tuberculosis, except when dealing with a lobar pneumonia which is very mild, or whose course is asthenic.

The examination of the blood is of no value in the diagnosis between lobar pneumonia and empyema or actinomycosis of the lung.

Well-marked leucocytosis in lobar pneumonia, while in itself a favorable sign, does not assure that the disease will pursue a favorable course, but indicates usually a severe infection.

A moderately low degree of leucocytosis in severe cases of lobar pneumonia is an extremely unfavorable sign.

In severe cases of lobar pneumonia absence of leucocytosis indicates, with rare exceptions, that the disease will prove fatal.

Most cases of lobar pneumonia in which the lesion extends to the pericardium and peritonæum are attended with slight leucocytosis.

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